an acknowledged authority, we find the number of species of *Rubus* increased from 41 to 45, while that of *Rosa* is reduced from 19 to 11, and of *Salix* from 32 to 29. We have never been able to understand on what principle Characeæ find a place in a work devoted to "Flowering Plants and Ferns," by the latter term being apparently meant Vascular Cryptogams. Prefixed to the work is a useful Glossary not found in the earlier editions; but the author has wisely refrained from acceding "to the wishes of some young botanists by prefixing a short Introduction to Botany." With the numerous admirable works now at their disposal, students ought to have no difficulty in making themselves acquainted with the Flora of the British Islands. A. W. B.

Eclipses, Past and Future, with General Hints for observing the Heavens. By the Rev. S. J. Johnson, M.A., F.R.A.S., Rector of Upton-Helions, Devon. (Parker, 1874).

THIS little book is a combination of two distinct treatises; one a description of past and future eclipses; the other, a catalogue of celestial objects falling within the range of such small telescopes as amateurs frequently possess. Each of these, it seems, was originally of greater bulk, and intended for separate publication, but they have now been condensed into a single small volume. This has the merit, not very common in these days, of being more than a mere compilation; the ancient eclipses, including those in the "Saxon Chronicle" (of which the author tells us no description has hitherto been published), having been approximately computed for the purpose from the tables in the "Encyclopædia Britannica;" and the notices of the planets, double stars, &c., being derived from actual observation. The book is pleasantly written, and without professing to go deeply into the subject, may well find readers among those who feel a general interest in astronomy, but have no intention of making it matter of serious or accurate study, or of going much beyond the limits of a 2¼ in. telescope. It would have been improved (without departing from its sketchy character) by a little more fulness and explicitness of treatment in some places; for instance, in the description of the belts and satellites of Jupiter, and where the abbreviated symbols of the Palermo Catalogue are left unexplained. Some misprints, too, have escaped in the revision. The following extract may interest our readers:—"For those who have very large telescopes, and who are not disposed to take them to oriental climates, it would be useful to have records of the number of clear nights in different parts of the kingdom. By clear nights, let us understand nights cloudless, or nearly so, till 11 P.M., or else clear for a full hour or two. Formerly my observations were taken in South Lancashire, but since the early part of 1870 in Devonshire. In 1859, the number of nights clear, partly or throughout, was 60; in 1860, 43; in 1861 and 1862, 46 each; in 1863, 47; in 1864, 83; in 1865, 82; in 1866, 77; in 1867, 55; in 1868, 62; in 1869, 58; in 1870, 112; in 1871, 98; in 1872, 90; in 1873, 82."

The Human Eye. By W. Whalley. (London: J. & A. Churchill.)

IN this small work the author tells us that he has incorporated the substance of a lecture on the subject, together with additions in various directions. He discusses, in a popular manner, the eye in man, and adds many facts with regard to its structure in other animals. His remarks are mostly anatomical, and we are disappointed to see so little notice of many physiological phenomena connected with the power of sight, which bring out the beauty of the organ of vision in a way which can be understood by the most amateur of readers. There is a want of consecutiveness in many of the paragraphs and chapters, though as a whole the book is a very readable one. Many of the instances given are wanting in grasp; for instance it is remarked that "In some of the ichneumons or 'Pharaoh's rats,' as the Egyptians call them, in the coatimundi, which somewhat resembles the racoon, and in the mangre, the osseous orbital ring is incomplete, and in a group of minor quadrupeds, entitled the Hyracidæ, the malar, or cheek bone, constitutes a perfect orbital ring." It is well known that the orbital ring is complete in all the Quadrumana and many Ungulata, and that it is absent in most other mammals; why then take the particular examples, which are not particularly good ones, and lay special stress on them. The deductions drawn are of a strongly teleological nature, and we cannot do better than recommend the author's reperusal of his work for the refutation of one of his concluding remarks, namely, that "In reviewing this very imperfect and disconnected sketch of the structure of the eyes of the different classes of animals, we cannot fail to recognise the fact that the human eye far transcends, both in mechanism and power, that of every other animal." We however deduce that the condor can see further, that many animals have an extra eyelid, and some bigger eyes than man himself, showing that his is inferior instead of superior in many respects.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. No notice is taken of anonymous communications.*]

Early Contributions to Spectrum Photography and Photo-chemistry

1. MY first attempt at photographing the fixed lines of the spectrum was made in 1834. It was on paper covered with silver bromide. As mentioned in the *Philosophical Magazine*, May 1843, it proved to be a failure. In the summer of 1842, simultaneously with M. Becquerel, by using daguerreotype plates, I succeeded, and in the following March sent a drawing of the photograph to the *Philosophical Magazine*, which was published in May. At that time I did not know that M. Becquerel was experimenting in the same direction.

The great lines α, β, γ, less refrangible than the rest, and which M. Lamansky has recently re-detected by the aid of the thermo-multiplier, are given in that drawing. These in the diffraction spectrum must be bands of very considerable width.

2. Sometimes a person is deprived of fair credit for his labour by what may be termed public perversity. I experienced this in the case of the chlorine and hydrogen photometer. The principle of this instrument is, that chlorine and hydrogen obtained in equal volumes by the electrolytic decomposition of hydrochloric acid, are made to reunite by exposure to light. I described a simple instrument of the kind in the *Philosophical Magazine* for December 1843. It still remains the most sensitive f all photo-o meters. Twelve years subsequently, Professors Bunsen and Roscoe modified it, and used it in their photo-chemical researches. In their memoirs, published in the Transactions of the Royal Society, they give full credit for the invention to me, and remark that by its use I had "succeeded in establishing experimentally some of the most important relations of the chemical action of light." They did justice in the matter, but not so the public. The instrument currently passes as their invention, not mine.

While speaking of photometers there is another to which I may allude. It depends on the principle that a solution of ferric oxalate is decomposed with evolution of carbonic acid on exposure to light. The carbonic acid may be measured or weighed by any of the ordinary methods. I described such an instrument in the *Philosophical Magazine*, Sept. 1857. Quite recently M. Marchand has published in his *Annales de Chemie* several experiments by its use, evidently unaware that it had been employed by me many years ago.

3. In 1843 I made photographs of the diffraction spectrum formed by a grating both by reflection and transmission, and published drawings of them. An account of this may be seen in the *Philosophical Magazine* June 1845 and March 1857. These were the first diffraction photographs ever made. They therefore preceded those of M. Mascart by many years. Of course they were not at all comparable with the very fine ones obtained recently by my son, Dr. Henry Draper.

4. In my memoir "On the production of light by heat" (Phil. Mag., May 1847), I established experimentally the following facts:—

(1) All solid substances and probably liquids become incandescent at the same temperature.

(2) The thermometric point at which some substances become red hot is about 977 Fahrenheit degrees.

(3) The spectrum of an incandescent solid is continuous; it contains neither bright nor dark fixed lines.

(4) From common temperatures nearly up to 977 F., the rays emitted by a solid are invisible. At that temperature they are red, and the heat of the incandescing body being made continuously to increase, other rays are added, increasing in refrangibility as the temperature rises.

(5) Whilst the addition of rays so much the more refrangible as the temperature is higher is taking place, there is an augmentation in the intensity of those already existing.

This memoir was published in both American and European journals. An analysis of it was read in Italian before the Royal Academy of Sciences at Naples, July 1847, by M. Melloni, which was also translated into French and English.

Thirteen years subsequently M. Kirchhoff published his celebrated memoir "On the relations between the coefficients of emission and absorption of bodies for light and heat." A translation of this memoir may be found in the *Philosophical Magazine*, July 1860.

In this memoir, under the guise of mathematical deductions, M. Kirchhoff, taking as his starting-point the condition discovered by Angström in 1854, respecting the relations between the emitting and absorbing powers of different bodies for light and heat, among other things deduces the following facts. I give them as they are succinctly stated by M. Jamin in his "Cours de Physique de l'école Polytechnique" (1869).

(1) All bodies begin to be red-hot at the same moment in the same space, and become white-hot at the same time.

(2) Black bodies begin to emit red rays near 525 C. (977 F.)

(3) The spectrum of solids and liquids is devoid of fixed lines.

(4) The rays first emitted by black bodies are red; to these are added successively and continually other rays, increasing in refrangibility as the temperature rises.

In his celebrated memoir, and in subsequent publications on the history of spectrum analysis, M. Kirchhoff abstains from drawing attention to the coincidences I am here pointing out, except that in a foot-note to his memoir he makes in a single word allusion to mine. But from this no one would infer what were really the facts of the case, and accordingly in the bibliographical lists subsequently published, in works on spectrum analysis, such as those of Prof. Roscoe and Dr. Schellen, my memoir is not noticed.

I earnestly solicit those who take an interest in the history of spectrum analysis to compare my memoir in the *Philosophical Magazine*, May 1847, with those published by M. Kirchhoff thirteen years subsequently, on the radiating and absorbing powers of bodies (Phil. Mag., July 1860), and on the history of spectrum analysis (Phil. Mag., April 1863).

JOHN WILLIAM DRAPER

University, New York, July 8

Sounding and Sensitive Flames

IN NATURE, vol. x. p. 223, Prof. Herschel describes some experiments recently made at the Newcastle College of Science, whereby sonorous vibrations are produced in tubes by means of heated wire-gauze instead of the ordinary gas flame. Interesting as are these experiments, they are, however, by no means new. The influence of heated wire-gauze in giving rise to vibrations of air within tubes was, I believe, first published by Prof. Rijke of Leyden. In Kœnig's catalogue for 1865, Rijke's tube is advertised (No. 27) and the method of experiment described. The readiest way of making the experiment is to cut a piece of the ordinary fine iron-gauze to the size of a sixpence or shilling, and press it some three inches up a glass tube of corresponding bore. Almost any length of tube over one foot may be employed, so that notes of varying pitch can be obtained. The gauze is easily heated by a little alcohol flame at the end of a bit of quill tubing. Employing platinum-gauze heated by an electric current, or a gas flame resting above the gauze, the sounds can be rendered permanent. By one or other of these methods no doubt many of your readers have, like myself, often repeated this experiment during the last six or seven years.

I notice also that Prof. Herschel has kindly attributed to me a modification of the ordinary sensitive flame; the credit of this belongs to Mr. P. Barry, of Cork. This arrangement simply consists of a sensitive flame burning on wire gauze, instead o directly from the gas jet. It was described in NATURE, vol. v. p. 30, and some further experiments on this kind of flame are to be found in the journal of the Franklin Institute for April 1872.

Perhaps it is not out of place to add here that when a sensitive flame under the influence of sound is viewed in a moving mirror, the state of its vibration, thus seen, reveals some interesting facts. Under such circumstances, the flame is capable of showing the nature of the different vowel sounds, and further, by the broken appearance of the flame one is able to detect sonorous vibrations too faint to be heard and too feeble otherwise to affect the flame. I have given a representation of the flame seen in a moving mirror on the plate appended to an article in the *Popular Science Review* for April 1867. The flame that is most suited for the vowel experiments happens to be the parent of the family of sensitive flames, and is described in a little paper of mine in the *Philosophical Magazine* for March 1867.

W. F. BARRETT

Science Schools, South Kensington, July 27

Aid to Private Research—Circulation of Scientific Memoirs

THERE are many scientific students scattered through the country, as science-masters in schools, and in other capacities, who are willing and competent to undertake original researches in their special branches of science. The great obstacle to their attempting it is, in most cases, the cost of the necessary instruments. It is of course impossible to expect such apparatus as is required for original work to be supplied from the science funds of a school, these being properly applied to provide only what is requisite for teaching the pupils; so that if an investigation is to be attempted, the whole cost falls upon one who is probably just beginning life, and is quite unable to afford it. The work is therefore postponed for a considerable period, and perhaps is given up altogether. Now the Department of Science and Art grants aid in fitting up the schools which are under its control. If the Department would give similar aid towards purchasing expensive apparatus for research, or would allow competent workers to hire such instruments for the period they require them, much of the difficulty to which I have alluded would be removed. Many, I am sure, would be glad to avail themselves of the opportunity, and would willingly fulfil the conditions necessary to ensure the safety and proper use of the apparatus. I may remark that by this means it would probably be easy to organise to a certain extent the investigations to be carried on, and thus render the results far more valuable than they would be if isolated. Looking to the national importance and the unremunerative character of this kind of work, few will think that this appeal is exorbitant.

I wish to allude to another point, to which attention has already been drawn in your correspondence columns (NATURE, vol. viii. pp. 506, 550). A scientific man, unless he is fortunate enough to be within easy distance of a large scientific library, is practically debarred from reading even the most valuable memoirs that are published. Abstracts, indeed, he may see; but these only serve to remind him that if he would get the original memoir for himself, he must purchase with it matter which is useless to him, but perhaps of the highest value to a worker in another branch. If these memoirs could be purchased in a separate form—or even if collections of papers bearing upon closely related subjects could be obtained—another cause of the costliness of science would be removed.

It has occurred to me that something ought to be done amongst ourselves to remedy our position as regards the transactions of the learned societies and the scientific periodicals. Could not a book-club be instituted, the members of which, upon paying a small annual subscription, should receive in turn the chief scientific periodicals? Or would it be more easy for a number of us who happen to take in different journals, to exchange them? If any of your readers should be inclined to co-operate with me in initiating either of these schemes, or to furnish any suggestions on the subject, I should be glad if he would communicate with me.

Sherborne, Dorset, July 11 H. W. LLOYD TANNER